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EXAMINER	
MURPHY, RHONDA L	

ART UNIT	PAPER NUMBER
2462	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/788,657	SHAO ET AL.	
	Examiner	Art Unit	
	RHONDA MURPHY	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 January 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *30-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *30-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is responsive to the communication filed on 1/7/11. Accordingly, claims 1 – 29 have been canceled and claims 30 -44 are pending.

Response to Arguments

1. Applicant's arguments filed 1/7/11 have been fully considered but they are not persuasive. Applicant argues Boariu fails to disclose a "vector of input symbols having size Nc x 1" wherein Nc is the number of subcarriers of the multicarrier wireless communication channel. However, Examiner respectfully disagrees. Boariu teaches a multicarrier wireless communication system in Fig. 1, col. 10, lines 62-63, wherein the vector of input symbols having size Nc x 1" wherein Nc is the number of subcarriers is disclose in col. 12, lines 60-66 (wherein vectors must be associated with a "size"). Additionally, Giannakis teaches the above limitation in col. 4, line 63 to col. 5, line 2. Applicant also argues Boariu fails to disclose "generating a rate-one, space frequency code matrix from the received content." However, Examiner respectfully disagrees, as Boariu teaches rate-one coding space frequency code matrix in col. 12, lines 48-53, which describes ***rate R=1*** *coding for 4 antennas*. Furthermore, the "generating" step is described in col. 12, lines 38-42.

2. In response to applicant's arguments related to the double patenting rejection raised in the office action dated 6/29/07, for now canceled claims 1 and 23, the pending claims 30, 35 and 40 are also rejected for claiming the same subject matter as the previously rejected claims 1-22. Pending claim 30, for example, encompasses the same

limitations recited in previously canceled claims 1-3. Thus, the double patenting rejection remains, and is reiterated below, wherein application number 10/789,387 is now US Patent 7,782,970.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 30, 35 and 44 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 7,782,970 . Although the conflicting claims are not identical, they are not patentably distinct from each other because claim 1 of patent '970 recites "*receiving content for transmission over a multicarrier communication channel having Nc subcarriers, the transmission to be made via a plurality of three or more transmit antennae, the number of transmit antenna being M and the received content being vectors of input symbols of size Nc.times.1; generating a rate-one, space-frequency code matrix from the received content for the transmission via the plurality of transmit antennae to a plurality of receive antennae, wherein generating the rate-one space frequency code matrix comprises: dividing a vector of input symbols into G groups of vectors, multiplying each of the G groups by a constellation rotation pre-coder to produce a number G of pre-coded vectors, dividing each of the pre-coded vectors into groups of subvectors*." However, the claim additionally recite "*utilizing the subvectors to generate a diagonal matrix, interleaving submatrices from the G groups to generate a rate-one space-frequency matrix of size M.times.Nc, wherein interleaving the submatrices from the G groups to generate a rate-one space-frequency matrix comprises generating a code word*

comprising a matrix of size M.times.Nc such that successive symbols in the same group are equi-spaced in the codeword; and transmitting the rate-one space-frequency matrix via the plurality of transmit antennae". In removing this limitation, the scope of the claim(s) is merely broadened by eliminating elements and their functions. It has been held that omission of an element and its function is an obvious expedient if the remaining elements perform the same function as before. In re Karlson, 136 USPQ 184 (CCPA). Also note Ex parte Rainu, 168 USPQ 365 (Bd. App. 1969) (omission of a reference element whose function is not needed would be obvious to one skilled in the art). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to not recite the above limitation.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 30 - 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boariu et al. (US 6,865,237) in view of Giannakis et al. (US 7,224,744).

Regarding claims 30 and 35, Boariu teaches a system (*Fig. 3*) comprising: a number M of bi-directional antennas, wherein M comprises more than two bi-directional antennas (*antennas 314, 316, 318*); and a diversity agent, to receive content for transmission via a multicarrier wireless communication channel (*elements within transmitter 300*), wherein the received content is a vector of input symbols (s) of size Nc x 1, wherein Nc is the number of subcarriers of the multicarrier wireless communication channel (*col. 12, lines 60-66*), and to generate a rate-one, space-frequency code matrix from the received content for transmission on the multicarrier wireless communication channel from at least a subset of the M bi-directional antennas (*col. 12, lines 44-53*).

Boariu fails to explicitly disclose dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (vg), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of MG subcarrier spacings, wherein M represents a number of transmit antennae.

However, Giannakis teaches dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (Vg)

(*col. 9, lines 1-15; col. 10, lines 15-23*), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings (*col. 10, lines 24-42*).

In view of this, it would have been obvious to one skilled in the art to divide the symbols into groups and multiply by a constellation rotation precoder, in order to reduce decoding complexity without sacrificing diversity or coding gains (Giannakis: col. 8, lines 60-61).

Regarding claims 31 and 36, the combined system of Boariu and Giannakis teach a method according to claim 30. Giannakis further teaches dividing each of the pre-coded vectors into a number of LM x 1 subvectors, and to create an M x M diagonal matrix = Dsg,k = diag{ΘTM×(k-1)+1Sg ,..., ΘTMxkSg }, where k=1...L from the subvectors (col. 9, lines 45-60; col. 10, lines 15-23).

Regarding claims 32 and 37, the combined system of Boariu and Giannakis teach a method according to claim 31. Giannakis further interleaving the L submatrices from the G groups to generate an M x Nc space-frequency matrix (col. 9, lines 32-55).

Regarding claims 33 and 38, Boariu teaches a method according to claim 32, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of the transmit antennae M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Regarding claims 34 and 39, Boariu teaches a method according to claim 30, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while

preserving a code rate of 1 for any number of the transmit antennae M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

6. Claims 40 – 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boariu et al. (US 6,865,237) in view of Giannakis et al. (US 7,224,744) and Csapo et al. (US 6,801,788).

Regarding claim 40, Boariu teaches a system (*Fig. 3*) comprising: a number M of bi-directional antennas, wherein M comprises more than two bi-directional antennas (*antennas 314, 316, 318*); and a diversity agent, to receive content for transmission via a multicarrier wireless communication channel (*elements within transmitter 300*), wherein the received content is a vector of input symbols (s) of size Nc x 1, wherein Nc is the number of subcarriers of the multicarrier wireless communication channel (*col. 12, lines 60-66*), and to generate a rate-one, space-frequency code matrix from the received content for transmission on the multicarrier wireless communication channel from at least a subset of the M bi-directional antennas (*col. 12, lines 44-53*).
Boariu fails to explicitly disclose dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (vg), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of MG subcarrier spacings.

However, Giannakis teaches dividing the vector of input symbols into a number G of groups to generate subgroups and multiplying at least a subset of the subgroups

by a constellation rotation precoder to produce a number G of pre-coded vectors (Vg) (*col. 9, lines 1-15; col. 10, lines 15-23*), wherein successive symbols from the same group transmitted from the same antenna are at a frequency distance that is multiples of NG subcarrier spacings (*col. 10, lines 24-42*).

In view of this, it would have been obvious to one skilled in the art to divide the symbols into groups and multiply by a constellation rotation precoder, in order to maximize spatial diversity.

Although Boariu teaches bi-directional antennas, Boariu fails to explicitly disclose omnidirectional antennas.

However, Csapo teaches omnidirectional antennas (*col. 1, lines 49-54*). In view of this, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Boariu's system to include omnidirectional antennas, for the purpose of enabling the antennas to transmit and receive signals in all directions.

Regarding claim 41, the combined system of Boariu and Giannakis teach a system according to claim 40. Giannakis further teaches the diversity agent further comprising: a space-frequency encoding element, responsive to the pre-coder element, to divide each of the pre-coded vectors into a number of LM x 1 subvectors, and to create an M x M diagonal matrix = Dsg,k = diag{ΘTM×(k-1)+1Sg ,..., ΘTMxkSg }, where k=1...L from the subvectors (col. 9, lines 45-60; col. 10, lines 15-23).

Regarding claim 42, the combined system of Boariu and Giannakis teach a system according to claim 40. Giannakis further teaches a system according to claim 41,

wherein the space-frequency encoding element interleaves the L submatrices from the G groups to generate an M x Nc space-frequency matrix (col. 9, lines 32-55).

Regarding claim 43, Boariu teaches a system according to claim 42, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of the transmit antennae M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Regarding claim 44, Boariu teaches a system according to claim 40, wherein the space-frequency matrix (col. 12, lines 44-50) provides MNL channel diversity, while preserving a code rate of 1 for any number of the transmit antennae M, receive antenna(s) N and channel tap(s) L (col. 12, lines 51-63).

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RHONDA MURPHY whose telephone number is (571)272-3185. The examiner can normally be reached on Monday - Friday 9:00 - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (571) 272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rhonda Murphy
Examiner
Art Unit 2462

/R. M./
Examiner, Art Unit 2462

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Primary Examiner, Art Unit 2462